

## REMARKS

### Status of Claims

Claims 1- 4, 7-13, 15-16, 20-22 are pending.

Claims 5-7, 14, and 17-20 are canceled.

### Interview Summary

Applicant wishes to thank the Examiner for the telephone interview of September 2 between the Examiner and the undersigned, during which time strategies were discussed regarding how to bring the case into compliance with the final office action. In particular, Applicant is grateful for the Examiner's suggestion to substitute in the claims the terms "black body" and "infra-red radiation emitted from a black body" in place of the terms "scene" and "heat from a scene." This amendment is supported in the specification at paragraph [0024]. Applicant has herein amended claims 1, 10, 15, 16, and 22 in accordance with the Examiner's suggestions. Applicant has also cancelled claims 7 and 20. Applicant thanks the Examiner for the time and guidance.

### Applicant's Comments to Examiner's Response to Arguments

Applicant incorporates by reference its comments from its prior three written correspondences and the telephone interviews of April 10 and September 2, and comments further as follows. In the office action of July 21, 2009 the Examiner stated that the phrase "external scene radiation," meaning radiation emitted by the scene, not onto to the scene from a source external to the scene, which Applicants rely on, is not recited in the rejected claims. The Examiner further stated that the features upon which applicant relies (i.e., thermal imaging systems and configurations thereof for sensing the thermal emission pattern of an external scene not otherwise illuminated) are not recited in the rejected claim(s).

Accordingly, Applicant has adopted herein the Examiner's suggestions provided in the telephone interview of September 2, and has amended the claims so as to use the term "black body" instead of "scene," and so as to use the phrase "infra-red radiation emitted by the black body" to describe the thermal radiation emitted by the black body. These changes are fully supported by the specification as filed. See for example paragraph [0024] of the specification. No new matter has been added.

Applicant repeats its assertion that Bakhle and Medina only provide teachings applicable to systems that form images by detecting radiation reflected by irradiated objects, and in particular that neither Bakhle nor Medina provides teachings applicable to an imaging system adapted for imaging infrared radiation emitted by an un-irradiated black body. Since the currently amended claims of the present application are clearly directed to imaging of infra-red radiation emitted by a black body, Applicant asserts that the currently amended claims cannot be obvious in light of any combination of Bakhle and Medina.

The Examiner has also taken issue with arguments previously presented by the Applicant regarding claims 7 and 20. Since these claims are currently cancelled, the Examiner's issues in this regard are moot.

The amendments included herein therefore fully align the claims with the arguments previously presented and thereby overcome the rejections. Since all of the claim amendments included herein are implementations of suggestions made by the Examiner, the Applicant believes that these amendments place the application in condition for allowance, and that no further examination is required.

#### **Claim Objections**

The Examiner has stated that in claim 1 (lines 11-12), "the internal radiant flux of the system to enter the system" should be changed to "--the internal radiant flux of the imaging system to enter the imaging system--," and has noted that claim 1 (line 1) is amended with the limitation "an imaging system", and claim 1 (line 9) recited limitation

"the imaging system." In harmony with other amendments made to claim 1, this phrase has been changed to "internal radiant flux of the thermal imaging based system to reach the plurality of pixels of the FPA"

The Examiner has stated that in claim 10 (lines 6, 8-9, 10) "the imaging system" should be changed to --the thermal imaging based system--. These changes have been made, as per the suggestion of the Examiner.

The Examiner has stated that in claim 15 (line 1), "a thermal imaging system" should be changed to --a thermal imaging based system--. This change has been made, as per the suggestion of the Examiner.

The Examiner has stated that in claim 15 (lines 4, 7, 9, 10-11), "the detector array" should be changed to --the thermal imaging detector array--. These changes have been made, as per the suggestion of the Examiner.

The Examiner has stated that in claim 15 (line 7), "lens" should be changed to --the lens--. This portion of text has been deleted, rendering the Examiner's objection moot.

The Examiner has stated that in claim 15 (line 7), "a thermal imaging based system" should be changed to --the thermal imaging based system--. This portion of text has been deleted from the claim, rendering the Examiner's objection moot.

The Examiner has stated that in claim 15 (line 9), "the system" should be changed to --the thermal imaging based system--. This change has been made, as per the suggestion of the Examiner.

The Examiner has stated that in claim 15 (line 10), "the imaging system" should be changed to --the thermal imaging based system--. This change has been made, as per the suggestion of the Examiner.

The Examiner has stated that in claim 15 (line 11), "the the heat radiating" should be changed to --the heat radiating--. This phrase has been amended to "the internal radiant flux and the heat radiating." This amendment renders the Examiner's objection moot.

The Examiner has stated that in claim 22 (lines 2-3), "the processing module" should be changed to --a processing module--. This change has been made, as per the suggestion of the Examiner.

The Examiner has stated that claim 22 (line 3-4), "the imaging system" should be changed to --the thermal imaging based system--. This change has been made, as per the suggestion of the Examiner.

Claims 2-4, 7-9 have been objected to as being dependent from claim 1. However, since the current amendments have removed the objections to claim1, this objection is moot.

Claims 11-13 have been objected to as being dependent from claim 10. However, since the current amendments have removed the objections to claim10, this objection is moot.

Claims 16, 20-22 have been objected to as being dependent from claim 15. However, since the current amendments have removed the objections to claim15, this objection is moot.

#### ***Claim Rejections - 35 USC § 112***

Claims 1-4 and 7-9 have been rejected under 35 U.S.C. 112, second paragraph. Specifically, the Examiner has stated that claim 1 (line 8) recites the limitation "the system," and that it is not known whether the limitation "the system" corresponds to the limitation "an imaging system," recited in claim 1 (line 1) or the limitation "a thermal imaging based system" as amended in claim 1 (line 2). However, the text containing the

phrase “the system” is currently deleted in claim 1. Therefore, the rejection of claim 1 under 35 USC 112 is moot.

Claims 2-4 and 7-9 have been rejected as being dependent from claim 1. However, since the rejection of claim 1 under 35 USC 112 is moot in light of current amendments, and since claim 7 has been cancelled, the rejection of claims 2-4 and 7-9 is moot.

**Claim Rejections – 35 USC § 103**

The Office has substantially repeated its prior rejections using the same references and the same arguments as in the prior Office Actions. Applicant in traverse incorporates by reference its prior arguments and the telephone interviews of April 10 and September 2, and comments further as follows.

Claims 1-4, 8-13, 15-16, 21-22:

The Office rejected claims 1-4, 8-13, 15-16, and 21-22 under 35 U.S.C. 103(a) as being unpatentable over Bakhle et al. (US 6,061,092) in view of Medina US 5,08 1,530). Applicant has carefully considered the Office rejections and respectfully submits that the currently amended claims, as supported by the comments above and the arguments herein, are distinguishable from the cited references.

It is not enough to merely attribute the elements of the Applicant’s claims to the references and summarily conclude the claims to be obvious. “[R]ejections on obviousness grounds cannot be sustained by mere conclusory statements; instead, there must be some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness. *See Lee*, 277 F.3d at 1343-46; *Rouffett*, 149 F.3d at 1355-59.” *In re Kahn* (Fed. Cir. 2006, 04-1616).

The Applicant’s disclosure, and the claims as amended, are directed particularly to *thermal imaging based systems and configurations thereof for sensing the infra-red*

radiation emitted by a black body that is not otherwise illuminated. Due to the very low energy levels characteristic of such infra-red radiation emitted by a black body, the internal radiant flux of the imaging system itself is typically orders of magnitude greater than the sensed infra-red radiation emitted by the black body. This is not true of systems that image light or other forms of energy that illuminate an object and are reflected thereby. Thermal imaging based systems therefore have unique characteristics and requirements not applicable to systems that image *reflected* energy.

Neither Bakhle nor Medina is directed to thermal imaging, and neither includes features that correct for internal radiant flux within the imaging system. In order to differentiate the very low level of infra-red radiation received from the black body from the internal radiant flux of the thermal imaging based system, the imaging systems according to the Applicant's invention must correct for the *all* internal radiant flux inherent in the thermal imaging based system, meaning and intending as is explained in the specification that all infra-red radiation reaching the focal plane array that is not derived from the black body needs to be included in the closed state image signal, so that their effects can be fully eliminated from the open state signal.

Put another way, the basic difference between the Applicant's invention and Bakhle's is that for Bakhle's CMOS devices, which detect reflected radiation, the dominant source of noise is the Dark Fixed Pattern Noise (DFPN) inherent to the detector array. The precise location of the shutter in relation to the lenses and other elements of the imaging system of Bakhle is therefore unimportant. In contrast, for focal plane arrays used in thermal based imaging systems such as the systems of the present invention, particularly un-cooled focal plane arrays, significant noise and image distortion arises due to detection of infra-red radiation emitted from various portions of the thermal based imaging system, including lenses and other elements, as well as from noise and non-uniformities inherent to the detector array. Since these infra-red emissions generated by the lenses and other elements fall non-uniformly on individual detectors in the focal plane array, they are a source of non-uniform detector response. By placing the shutter in front of the entire thermal based imaging system, the present

invention ensures that all infra-red emissions from all portions of the thermal based imaging system are detected in the closed state, so that all of the effects therefrom can be subsequently removed from images obtained in the open state. Otherwise, the correction process would be only partially successful, correcting for noise and distortions inherent in the detector array DFPN, but not for the imaging system emission induced DFPN. Therefore, the Examiner's assertion is clearly incorrect that it is merely a design choice to dispose the shutter of the present invention in front of the lens or behind the lens.

Referring to Applicant's paragraphs [0016], [0024], [0025], Figure 1, and paragraphs [0027], [0028], and elsewhere in the specification, the details and advantages of the claimed shutter configuration are further explained. The convention of thermal imaging systems at the time of the invention was to place the shutter adjacent to the FPA, for several practical reasons. Systems were commonly cryogenically cooled. The lens was confined within the cooling envelope. There was room between the lens and the FPA for the shutter, and placement there kept the shutter relatively small. The conventional packing configuration made sense at the time. Applicant further provides among the claims for correcting for offset using external open and closed shutter states where the internal flux is always present, and for correcting pixel-to-pixel non-uniformities, which for example might include correcting pixel gain using different reference level black body signals. Applicant is not aware of any thermal imaging system technology of the day that recognized or embraced the idea of putting the shutter outboard of the thermal based imaging system and correcting image signals in the manner claimed, and for the advantages described.

Regarding claims 1, 10, 15 and 16, as currently amended, Bakke is acknowledged to fail to disclose the claimed shutter/lens/FPA configuration where closing the shutter allows all sources of internal flux to be detected in the closed state. In addition, the teachings of Bakke are relevant only to reflected radiation imaging systems rather than thermally emitted black body infra-red imaging systems. Since reflected radiation is relatively intense, any internal radiant flux or infra-red emission present in the systems

of Bakke is not a major consideration, and the dark image subtraction data need only be sensitive to electronic conditions within the focal plane array itself rather than to the full range of internal system emissions and/or fluxes to which the FPA is exposed. Bakke is conventional in its configuration, is not directed to the same art as the present invention, and in fact teaches away from the present invention of in that *it teaches, by implication, that the shutter is best placed between the lens and the FPA.* In light of the current amendments and these remarks, Applicant requests that the rejection be withdrawn.

Medina discloses a video-imaging camera system, again not directed to the unique characteristics of thermal imaging based systems. Since the Medina imaging system images reflected visible light, the objects that are imaged thereby are well illuminated, so that the intensity of the reflected radiation received from the imaged objects is extremely high compared to internal system conditions. Therefore, in the teachings of Medina, the precise location of the shutter is of little consequence to the performance of the apparatus, and the shutter can be placed anywhere where isolation and light control is easily managed. For systems such as those disclosed by Medina, other more basic criteria dominate the decision of where to locate the shutter, such as simple packaging design, component sizing, and cost of manufacturing. Applicant asserts that it would therefore not have been obvious to those skilled in the art of thermal imaging based systems in view of Bakke, and also Sato, Thomas and Yoshida, to adopt the front-of-lens shutter configuration used by Medina in the distinct and somewhat unrelated art of reflected energy imaging based systems. In light of the current amendments and these remarks, Applicant requests the rejection be withdrawn.

Regarding dependent claims 2-4, 8, and 9, Applicant incorporates its above remarks and asserts these claims to be allowable at least by reason of being dependent on an allowable base claim, and respectfully quests reconsideration.

Further regarding independent claim 10, the Examiner has admitted this to be a method claim of the apparatus of claim 1. Applicant asserts this to be true with regard to the claim as amended, and asserts claim 10 to be allowable on that basis.

Regarding claims 11-13, Applicant incorporates its above remarks and asserts these claims to be allowable at least by reason of being dependent on an allowable base claim, and respectfully requests reconsideration.

Regarding claims 15 and 16, the Office has admitted claim 15 to have all the limitations of claim 1. Applicant asserts this to be true with regard to the claims as amended, and asserts that claims 15 is allowable for at least this reason, and because claim 16 is dependent upon claim 15, claim 16 is allowable at least by reason of being dependent on an allowable base claim

Claims 7 and 20 have been cancelled. The Examiner's rejections thereof are therefore moot.

Applicant believes the above amendments and remarks to be fully responsive to the Office Action of July 21, thereby placing this application in condition for allowance. Since the current amendments fully implement the recommendations of the Examiner made in the telephone interview of September 2, Applicant believes that the current amendments bring the application fully into compliance with the Examiner's office action of July 21, and that the application in its present form is therefore allowable without further Examination. No new matter is added herein. Applicant requests speedy consideration, and further requests that Examiner contact its attorney by telephone, facsimile, or email for quickest resolution, if there are any remaining issues.

Respectfully submitted,

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